6th Grade Science Aquino/Brackett
20 Day Lesson Plan:

Standards/SEP	6.L.5B The student will demonstrate an understanding of the structures, processes, and responses that allow protist, fungi, and **plants** to survive and reproduce 6.L.5B.1 Construct explanations of how the internal structures of vascular and nonvascular plants transport food and water. 6.L.5B.3 Develop and use models to compare structural adaptations and processes that flowering plants use for defense, survival and reproduction. 6.L.5B.4 Plan and conduct controlled scientific investigations to determine how changes in environmental factors (such as air, water, light, minerals, or space) affect the growth and development of a flowering plant.
Learning Targets/ I Can Statements	➢ I can construct explanations on how plants, both vascular and nonvascular transport food. ➢ I can construct models/diagrams to express how nutrients are transported in plants. ➢ I can construct explanations on how plants, both vascular and nonvascular transport food. ➢ I can construct models/diagrams to express how nutrients are transported in plants.
Essential Question(s)	➢ Explain the difference in nutrient transport in vascular vs. nonvascular plants. ➢ How do the processes of photosynthesis, transpiration, and respiration endure plant survival? ➢ What are the differences between structural adaptations for defense and structural adaptations for survival?
Resources	Pencil Workbook Pages Reading Comprehension Assignments usatestprep.com
Learning Activities or Experiences	➢ Day 1: 4/3/2020- Read the Reading Passage **"The Venus Flytrap"** . Underline the important facts and circle the key terms. Answer Questions 1-4 ➢ Day 2: 4/6/2020- Reread the Reading Passage **"The Venus Flytrap"** Answer Questions 6-10 . Write a short summary (5-6 sentences) about how this article relates to your life. ➢ Day 3: 4/7/2020- Read the Reading Passage **"All The Pieces That Matter"** . Underline the important facts and circle the key terms. Answer Questions 1-4 ➢ Day 4: 4/8/2020- Reread the Reading Passage **"All The Pieces That Matter"** . Answer Questions 6-10. Write a short summary (5-6 sentences) about how this article relates to your life.

- Day 5: 4/9/2020- Read the Reading Passage **"Rhubarb Grows in the Dark"** . Underline the important facts and circle the key terms. Answer Questions 1-4

- Day 6: 4/20/2020- ReRead the Reading Passage **"Rhubarb Grows in the Dark"** . Answer Questions 6-10. Write a short summary (5-6 sentences) about how this article relates to your life.

- Day 7: 4/21/2020- Read the Reading Passage **"Life Finds A Way"** . Underline the important facts and circle the key terms. Answer Questions 1-4

- Day 8: 4/22/2020- ReRead the Reading Passage **"Life Finds A Way"** . Answer Questions 6-10. Write a short summary (5-6 sentences) about how this article relates to your life.

- Day 9: 4/23/2020- Read the Reading Passage **"Secrets Of Survival**" . Underline the important facts and circle the key terms. Answer Questions 1-4

- Day 10: 4/24/2020- ReRead the Reading Passage **"Secrets of Survival"** . Answer Questions 6-10. Write a short summary (5-6 sentences) about how this article relates to your life.

- Day 11 4/27/20 Complete Lesson Outline Pages 1-3

Read Plant Diversity "What is a Plant" to assist you in completing your work.

- Day 12 4/28/2020 Complete Content Practice B Pages 4-5

Read Plant Diversity "What is a Plant" to assist you in completing your work

- Day 13 4/29/2020- Answer School to Home Pages 7-9
  Read "What is a Plant" Reading Passage to assist you in completing your work.

- Day 14 4/30/2020- Complete Key Concept Builder Pages 10-12
  Read "What is a Plant" Reading Passage to assist you in completing your work.

- Day 15 5/1/2020- Key Concept Builder Pages 13-14
  Read "What is a Plant" Reading Passage to assist you in completing your work.

- Day 16 5/4/2020 Complete Lesson Outline(LESSON 3) Pages 1-3,
  Read Plant Diversity "Seed Plants" as your reference.

- Day 17 5/5/2020 Complete Content Practice A Pages 4-6
  Read Plant Diversity "Seed Plants" as your reference.

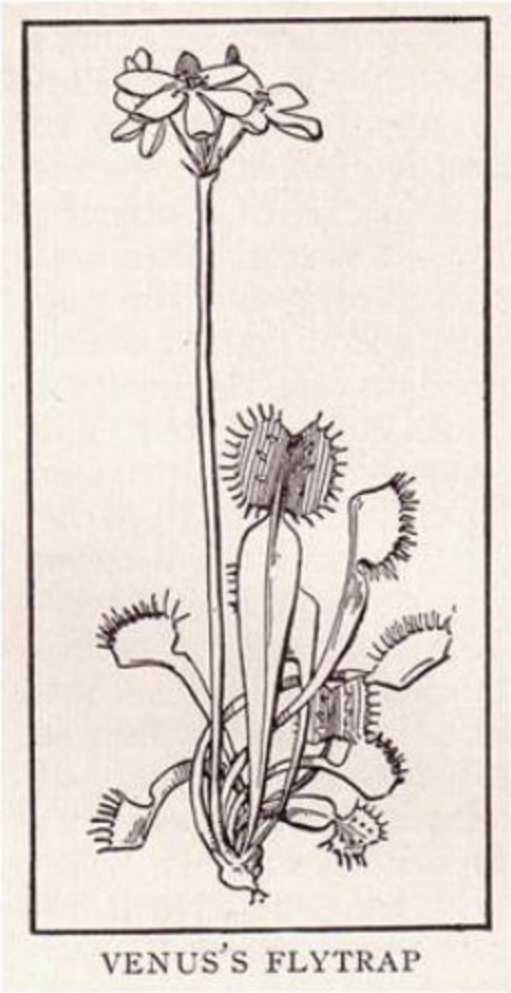
- Day 18-20 5/6-5/8/2020- Complete Lesson 3 Key Concept Builder Pages 7-14
  Read Plant Diversity "Seed Plants" as your reference.

Office Hours	I am available Monday-Friday from 9:30-11:00 AM and 1:00-2:30 PM to answer questions through email at Josephine.aquino@richlandone.org/vivian.brackett@richlandone.org

**Note: Students must complete and submit all required assignments. **

The Venus Flytrap

by ReadWorks



The Venus flytrap is an insect-eating plant that lives mostly on the East Coast. Found primarily in swampy parts of the United States, like North and South Carolina, the Venus flytrap has colorful pink and green hues. Like most other plants, Venus flytraps get some nutrients from the soil, but since swampy areas tend to have soil that is nutrient-poor, it is hard for the plant to get nutrients from there. As a result, the flytrap has evolved to not only rely on the soil to survive. The Venus flytrap is a carnivorous plant because it catches insects and eats them to get the nutrients that it can't get from the soil.

The Venus flytrap has leaves that open to catch prey and then snap shut once it's ready to eat. On the inside of each leaf there are short, stiff hairs called trigger hairs. When an insect touches one of the three trigger hairs on either side of the leaf twice in a row, it signals to the flytrap that dinner is here. The leaves then snap shut, trapping the insect inside. Of course, some insects are able to escape, but many don't. And if they try and struggle to get out, the trap closes even tighter! The trap doesn't close all the way, though. It stays open for a few seconds, so smaller insects that might be trapped inside with the main meal can crawl out. Venus flytraps don't like to eat small insects because they don't provide a lot of nutritional value. If it's not an insect that is trapped, rather a nut or a stone, the trap will open after about 12 hours and spit it out. The inside of a flytrap has fingerlike tentacles

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that help keep the insect from escaping. If you fold your hands together and lace your fingers on the inside, you'll get an idea of what the trap looks like.

In order to digest or eat the insect, the flytrap must squeeze its prey very tightly, as digestive juices dissolve the inside of the insect. At the end of this process, which takes anywhere from 5 to 12 days, the trap opens up again, and either rain or wind will carry the insect's remaining exoskeleton away. If the flytrap has caught an insect that is too big, and, say, the legs of the bug are sticking out of the trap, the digestion process might not happen the way it should. The trap will grow mold and once that happens, it will continue to get sicker and sicker, with the trap eventually turning black and falling off.

The exact amount of time it takes for the trap to open back up again depends on a variety of factors. These factors include the size of the insect, temperature, how old the trap is, and how many times the plant has gone through this process. In fact, the trap can only catch about three of its prey before it turns black, dies, and falls off. The trap can only open and close about seven times; that is why it is important to not go around touching the trap in order to get them to close. So if you ever see one, don't tease it!

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Name: _____ **Date:** _____

1. What is the Venus flytrap?

A. a plant-eating insect
B. an insect-eating plant
C. swampy, nutrient-poor soil
D. a plant that grows on Venus

2. What does the author describe in the passage?

A. the species of insects the Venus flytrap eats
B. plants that are similar to the Venus flytrap
C. the swampy regions of North and South Carolina
D. how the Venus flytrap catches and eats its prey

3. The trap of the Venus flytrap may not last long. What evidence from the passage supports this conclusion?

A. The trap opens up again 5-12 days after catching and eating an insect.
B. The trap stays open for a few seconds so that smaller insects can crawl out.
C. The trap must squeeze the prey very tightly in order to digest or eat the insect.
D. The trap can only catch about three of its prey before it dies and falls off.

4. What was the Venus flytrap forced to adapt to?

A. an environment without any other plants
B. an environment with nutrient-rich soil
C. an environment without nutrient-rich soil
D. an environment without any large animals

5. What is the passage mainly about?

A. different types of carnivorous plants that live in swamps
B. the Venus flytrap and how it catches its prey
C. the swampy areas where the Venus flytrap lives
D. why the trap of the Venus flytrap turns black and fall off

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6. Read the following sentence: "The inside of a flytrap has fingerlike **tentacles** that help keep the insect from escaping."

The author compares **tentacles** to what?

A. insects
B. flytraps
C. insects
D. fingers

7. Choose the answer that best completes the sentence below.

The Venus flytrap cannot get enough nutrients from the soil in which it grows. _____, the Venus flytrap evolved to get nutrients from an additional source.

A. Finally
B. Moreover
C. Although
D. Consequently

8. Where does the Venus flytrap get its nutrients?

9. Describe the process by which the Venus flytrap catches and digests its prey.

10. How has the trap of the Venus flytrap helped this plant to survive?

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All the Pieces Matter

by A.P. Raj

Jason stared at the whiteboard at the front of the classroom, trying to make sense of what he saw there. Mr. Freamon had drawn a complicated diagram of all the creatures living in the nearby Ho Tep Wildlife Reserve. Every type of living thing, from trees and insects to mammals and birds, was written down and circled on the board. Arrows snaked around the board, connecting the circles, showing which creatures depended on which other creatures to survive.

Though he had been hiking out in Ho Tep plenty of times, Jason had never given much thought to the animals and other wildlife he had seen out there. He'd never thought about how the amount of rainfall affected the amount of moisture in the soil, which affected how well plants could grow, which affected the ability of the animals that ate those plants to survive. It was enough to make his head swim a little.

Jason wasn't the only one who was confused. Mr. Freamon could tell that his students were all struggling to make sense of the mess of connections drawn out on the board. He smiled and stopped drawing for a moment to speak to the class.

"Take a deep breath," Mr. Freamon said. "You don't need to memorize what's on the board. If you're going to take away one thing from this lesson, let it be this: All the pieces matter. Every ecosystem on Earth depends on a delicate balance among all of the different forms of life within it."

Adriana raised her hand and asked why that was.

"Well," Mr. Freamon said, "in any ecosystem, all of the creatures within it are competing for the same

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resources: food, water and shelter-the basic needs of every living thing. There's only so much to go around, so creatures have to compete with other creatures to get what they need. And since they all go about it in a unique way, all of the creatures in an ecosystem end up depending on one another. Let me give you an example.

"Remember that video we watched last week? With the wolves killing the elk at Yellowstone National Park?"

Everyone nodded.

"And how many of you thought that the wolves were mean for killing those elk?"

About half the students raised their hands, but Jason kept his hand down. Wild animals will do what they do, he thought. The idea of meanness never enters into it. They act on instinct.

"Consider this, then," Mr. Freamon continued. "Without the wolves in the park to keep the elk population in check, the elk would have eaten all of the aspen and willow in the park. Not only would those plants be gone, but the other animals that depend on them to survive, would have been out of luck too. All the pieces matter."

After class that day, Jason went home and looked up "ecosystem resilience" on the Internet. He found a lot of interesting links about different ecosystems that had changed rapidly because one of the pieces had been taken out of the puzzle, as Mr. Freamon would have put it.

In Africa, people hunted lions and leopards and reduced their population, leading to higher populations of a certain type of baboon. That had led, somehow, to higher rates of parasites in baboons and people. And along some coasts, human activity had reduced the sea otter population. The sea otters ate sea urchins that ate kelp from massive kelp forests. Without the sea otters to keep them in check, the kelp started to disappear.

The whole idea was starting to make sense to Jason. It was basically like dominoes-all the pieces lined up, and if you knocked one down, it would knock down the next one, which would knock down the one after that, until they all went down. Of course, it was a lot more complicated than that, but that was the basic idea.

The next time Jason went to Ho Tep Wildlife Reserve, on a camping trip with his dad, he made a point of observing the wildlife. He spent twenty minutes watching a copperhead snake slither across the forest floor, wondering about its role in the larger system. Through his binoculars, he watched a robin build its nest near the top of an oak tree. He imagined the robin catching insects to bring back to the nest to feed her chicks. He thought about how the roots of the tree reached way down into the soil to drink the moisture there. It really was fascinating how everything fit together.

Later, when he was back at school, he asked Mr. Freamon about the ecosystem at Ho Tep. He mentioned how he thought about the trees and how they were rooted in the soil.

"It's funny you should mention that, Jason," Mr. Freamon said. "You know, without those trees to anchor the soil, Ho Tep would still be a desert, like it was thousands of years ago."

"You mean Ho Tep hasn't always been a forest?"

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"No, it hasn't. For a long time it was a desert-a totally different ecosystem. But over time, things changed," Mr. Freamon said.

"What things?" Jason asked.

"Weather patterns, for one. There probably wasn't a lot of rain falling on that area for a long time. But as that changed, there was more moisture in the soil. Enough for flowering plants to begin to take root, and eventually trees," replied Mr. Freamon.

"And once there are trees, there's shelter for birds and other animals," Jason said.

"Exactly right," Mr. Freamon said. "You've got the idea."

"Does that mean that we can deliberately change an ecosystem? Turn a desert into a forest, or something like that?"

Mr. Freamon smiled. "Well, it isn't that simple. Nature has a way of changing itself, but it takes a very long time, and it doesn't have an end goal in mind. Ecosystems fall apart, and then eventually find a new way to rebuild. But that's not quite the same as planning out a change.

"There are so many variables to consider- not only things like trees and birds, but the bacteria and other creatures you can only see with a microscope. Not to mention, we haven't exactly figured out how to change the weather."

"So we've never changed an ecosystem?" Jason asked.

"Oh, I wouldn't say that," Mr. Freamon said. "We've changed plenty of ecosystems all right. Except when humans change an ecosystem, it's usually not deliberate. Usually it's because clearing out land to build things drives out other creatures."

"Well, it's like you always say: humans are a part of nature too, right?"

"Exactly right, Jason," Mr. Freamon said. "That's exactly right."

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Name: _____ **Date:** _____

1. According to Mr. Freamon, creatures within an ecosystem compete for which resources?

A. shelter and plants
B. water and animals
C. food, water, and shelter
D. plants and animals

2. What is the setting at the beginning of the story?

A. Jason's school
B. Ho Tep Wildlife Reserve
C. a desert
D. Africa

3. When Jason gets home he looks up "ecosystem resilience" on the Internet.

Which conclusion can you draw from this evidence?

A. All the students looked up "ecosystem resilience" when they got home from school.
B. Jason is trying to understand the concept Mr. Freamon introduced in class.
C. Jason is rarely allowed to use the Internet at home.
D. Jason has an assignment on "ecosystem resilience" in another class.

4. Based on the passage, what is an ecosystem?

A. the living things and environment of a certain area
B. only the living things of a certain area
C. only the environment of a certain area
D. a forest

5. What is the passage mainly about?

A. the ecosystem in the Ho Tep Wildlife Reserve
B. Jason learning about how everything in nature is connected
C. the relationship that develops between Jason and his dad on their camping trip
D. how Ho Tep changed from a desert to a forest

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6. Read the following sentences from the second paragraph of the story: "He'd never thought about how the amount of rainfall affected the amount of moisture in the soil, which affected how well plants could grow, which affected the ability of the animals that ate those plants to survive. It was enough to make his head swim a little."

What does the author mean when he writes that all the new information "**was enough to make his head swim a little**"?

A. Jason loves swimming.

B. Jason does not like learning about nature.

C. Jason understands the new information perfectly.

D. Jason is confused.

7. Choose the answer that best completes the sentence below.

Everything in nature is connected; _____, sea otters, sea urchins, and kelp populations all affect each other.

A. on the other hand

B. earlier

C. for example

D. but

8. According to Mr. Freamon, what does every ecosystem on earth depend on?

9. Give an example from the passage of how two or more animals are connected to each other, and why the connection is important for the ecosystem.

10. Explain what Mr. Freamon means when he says "all the pieces matter." Use information from the passage to support your answer.

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Rhubarb Grows in the Dark

by ReadWorks

Marco Pierre White was England's first celebrity chef. He was the first Briton to win three Michelin stars. He was the first chef to make British cooking stylish.

In 2008, White filmed a four-part television program about British food. In the first episode he stops at a Yorkshire Rhubarb farm. White grew up in Leeds, so he knows Yorkshire County well. On the drive to the farm, White remarks that he remembered a time when every home in Yorkshire had a rhubarb patch.

White was nostalgic for a particularly British culinary tradition. Yorkshire, England has long been known for its early season rhubarb. White was on his way to see Janet Oldroyd Hulme, a woman who has become known as the "High Priestess of Rhubarb." Hulme runs E. Oldroyd and Sons, a fifth generation farm in Carlton, England. E. Oldroyd and Sons specializes in early rhubarb. The farm is near the Rhubarb Triangle, a 9-square-mile area that has been awarded a Protected Designation of Origin status for its role in British culinary and agricultural history. At one time there were over 200 growers in the area and they produced 90 percent of the world's winter rhubarb.

Rhubarb is a vegetable, although it is considered a fruit in the United States for legal reasons. It is

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native to Siberia and arrived in Britain in the 13th century. Valued for its medicinal applications, only the rhubarb root was used for centuries. The plant's red stalks and dark green leaves were bitter and considered inedible. (The leaves contain a high amount of oxalic acid, which can be poisonous.)

These days the rhubarb stalk is used in pies, puddings and sauces. It's sweet, but not too sweet. To make rhubarb pie filling, you cut the rhubarb into inch-long pieces and simmer it with some water, sugar and jam.

Rhubarb has become an ingredient of traditional British food. For his television program, Chef White visited Hulme to talk about rhubarb's transformation. He arrived at her farm and surprised her in a packing room where she was boxing up bright red stalks of rhubarb for shipment. After they introduced themselves, Hulme took White into one of her wooden rhubarb sheds. She opened a low door, and the two of them ducked under the lintel and through a plastic screen. Holding a flashlight and leading the way, Hulme said, "Step into my secret world."

Inside the shed were rows and rows of rhubarb stalks growing out of potting boxes. Everywhere bright red stalks topped with small yellow leaves were reaching for the ceiling. The room was dark except for the light of a few candles. It was also quiet. White likened the space to a church. Of course, Hulme's shed is hardly a church. But it is full of a vital energy. Perhaps this is why Hulme is described as a priestess.

The word priestess also implies Hulme has a special power. Indeed, Hulme uses the shed to produce rhubarb using a classic English technique called *forcing*. Forcing means inducing the plant to grow according to the grower's schedule. Forcing was widely used in England during the 19th century. Gardeners covered plants with large terra cotta pots, called forcing pots, or brought plants into dark cellars. The process was applied to flowering plants and vegetables.

It was a happy accident that extended this process to rhubarb. At the beginning of the 19th century, rhubarb was cultivated at the Chelsea Physic Garden in London. The stalk and leaves were not used at all. Legend has it that in 1817, workmen accidentally covered rhubarb roots with soil. Weeks later, the soil was removed and someone noticed delicate pink shoots of rhubarb stalks growing from the roots. These stalks were discovered to be much less astringent than the typical rhubarb stalks.

Horticulturalists took note of this development and began experimenting with alternative methods of growing rhubarb plants. *The Royal Horticultural Society of Great Britain's Quarterly Journal of Art, Science and Literature* records an account of forced rhubarb cultivation in its 23rd Volume, dated 1827. On March 6th it states:

A paper from the Society's gardener was read, upon the best method of forcing rhubarb for tarts and fine specimen of the leaves, forced in this manner, were placed upon the table. The method was simply this: The seed is sown in a rich border, in the first week of April; the young plants are kept thin and clean during the summer, and before the growing season is fully over, they are taken up, put into common forcing pots, three in each, and placed in a shaded border till they are wanted. In January or February they are put in the forcing-house and submitted to a very gentle heat. This is the most simple, effectual, and certain method of forcing rhubarb yet known.

The English quickly developed an appetite for rhubarb. Thanks to forcing, it became one of the only fresh foods available at the beginning of spring. It soon became one of the most popular vegetables available. Yorkshire was an ideal location for large-scale cultivation. Local coal mines provided an

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energy source for heating the forcing sheds. Farmers used the local wool industry's wool waste, an excellent source of nitrogen, to fertilize their fields. By the end of the 19th century Yorkshire rhubarb was big business. There was a special express train run from Yorkshire to London between Christmas and Easter.

Not much has changed at the surviving Yorkshire forcing sheds since the 1820s. In today's rhubarb farms, like those owned by Hulme, the plants spend two years out in the open, absorbing sunshine and storing energy. The energy is stored as carbohydrates in the plants' roots. After two years, the plants are moved into the forcing shed.

The rhubarb sheds are kept warm and very dark. This tricks the rhubarb roots into growing to full size within a few weeks. These conditions trick the rhubarb plants into acting like seeds. Seeds start in the same conditions - it's warm and dark in the earth - and use their stored sugars as energy to grow out of the ground and towards the sun. The rhubarb plants in the forcing sheds "think" they are back in the ground. They grow upwards, trying to get to the sun, and put the energy that would normally be used for growing leaves into growing tall. Visitors to the forcing sheds of Yorkshire say they can hear the sound of popping as the rhubarb stalks emerge from the bud. Weeks later, the rhubarb is harvested by hand. Harvesters work in the candlelight, prying the arm-length rhubarb stalks from their roots. By the end of the harvest, usually in March, the root stock is spent and used as compost.

Forcing a plant deprives it of photosynthesis and weakens the plant. In the case of rhubarb, however, the effects of forcing have positive outcomes for culinary uses. The rhubarb plants grown in the dark, relying on stored energy, put their energy to use growing stalks, not leaves. (The leaves they grow are a pale yellow and atrophied in comparison to rhubarb grown outdoors.) If there were sunlight present, the plants would grow leaves to absorb sunlight. Since there is not any light present in the forcing shed, the rhubarb puts its energy to use growing longer stalks. As a result, the stalks are sweeter.

Chef White got his rhubarb from Hulme that day. He seems to have liked it. In 2011 Marco Pierre White was serving rhubarb crumble in his Dublin restaurant. The ingredients for the dessert were rhubarb, flour, butter, sugar, and almonds. It's served with ice cream.

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Name: _____ **Date:** _____

1. What has Yorkshire, England long been known for?

A. restaurants with Michelin stars

B. early season rhubarb

C. Chef Marco Pierre White

D. late season rhubarb

2. What does the author describe in the passage?

A. how Chef White won three Michelin stars

B. popular recipes for rhubarb pies, puddings, and sauces

C. medicinal applications of the rhubarb root

D. "forcing," a process of growing rhubarb

3. The business of forcing rhubarb helped grow the Yorkshire economy. What evidence from the passage supports this conclusion?

A. "There was a special express train run from Yorkshire to London between Christmas and Easter."

B. "Yorkshire was an ideal location for large-scale cultivation."

C. "Not much has changed at the surviving Yorkshire forcing sheds since the 1820s."

D. "On the drive to the farm, White remarks that he remembered a time when every home in Yorkshire had a rhubarb patch."

4. Why might rhubarb harvesters work in candlelight?

A. to keep the plants "thinking" it is nighttime

B. to keep the electricity costs low

C. to keep the plants "thinking" they are underground

D. because rhubarb plants grow faster in low light

5. What is this passage mostly about?

A. the reason why rhubarb was only used for medicinal purposes until the 19th century

B. how Marco Pierre White became England's first celebrity chef

C. the pros and cons of growing rhubarb using the forcing technique

D. the growing technique that popularized rhubarb as a British vegetable

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6. Read the following sentences: "The rhubarb plants grown in the dark, relying on stored energy, put their energy to use growing stalks, not leaves.(The leaves they grow are a pale yellow and **atrophied** in comparison to rhubarb grown outdoors.)"

What does "**atrophied**" mean?

A. withered
B. damp
C. robust
D. bloated

7. Choose the answer that best completes the sentence below.

Using the "forcing" method, rhubarb plants are forced to grow in the dark. _____, the plant grows stalks which are sweeter than normal.

A. However
B. As a result
C. Initially
D. For instance

8. What does "forcing" mean as used in the passage?

9. How do rhubarb farmers trick the plants into acting like seeds?

10. Explain the effects that "forcing" has on rhubarb plants.

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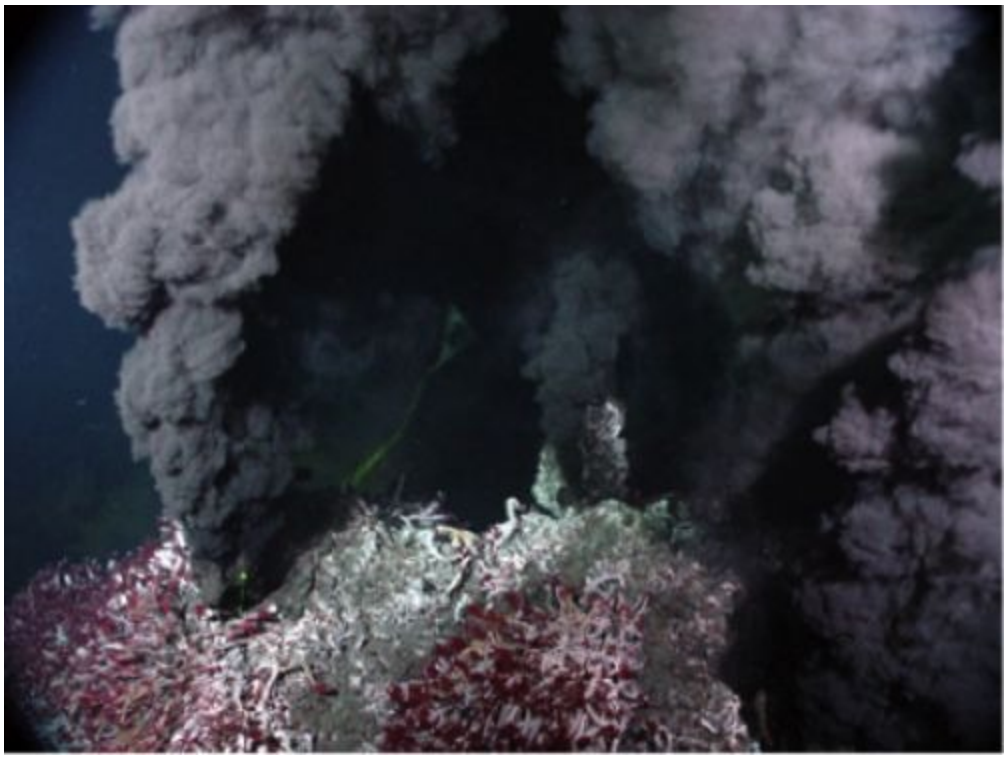
Life Finds a Way

by ReadWorks



Deep, deep under the ocean, there is a place unlike anywhere else on Earth. In a place so deep that it's impossible for sunlight to reach it, great rocky tubes shoot up from the sea floor. These tubes, or chimneys, belch out what looks like black smoke, all day and all night. The "smoke" is in fact a mixture of minerals from deep within the earth, which shoot out of the chimneys at extremely hot temperatures. For many years after these things (which scientists now call "hydrothermal vents") were discovered, scientists were sure that nothing could live anywhere near them.

They had lots of reasons to think this. For one, there was absolutely no sunlight. In one way or another, sunlight is the source of almost all life on the surface of earth. Plants use it to make food in a process called photosynthesis, some animals eat those plants, and other animals eat the plant-eaters. Without sunlight, the whole system falls apart, so how could there be any life somewhere that is so deep in the ocean that no light makes it down?

Secondly, the minerals in the smoke, mostly sulfur, were thought for a long time to be poisonous to most living things on Earth. With so much sulfur coming out of the ground at such high temperatures, for many years scientists were pretty confident that nothing could live around these vents.

After studying them for a long time, however, scientists made a shocking discovery. There was life around the vents. Tiny bacteria used the sulfur from the vents to make food - a process called "chemosynthesis." Other animals, like worms and shrimp, then ate this bacteria. A whole ecosystem exists there.

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Finding this life made scientists reconsider the power of evolution. They had thought for almost a hundred years that while life was adaptable to a certain extent, there were some things it simply couldn't do without: sunlight and oxygen being two. However, as the animals around the hydrothermal vents proved, life was much more adaptable than they had believed. Now, scientists think that life, just like it does around the vents, could exist right now on Europa, one of Jupiter's moons. Europa has long been known to have vast oceans, but scientists thought that being so far from the sun and having an atmosphere so thin that it can't hold in much air, life would not be possible there. Now, it seems like those factors might not matter as much as previously thought. Some scientists also think that Mars may have once had life on its surface.

As the undersea vents example shows, life is extremely adaptable. All different kinds of places on Earth have animals and plants that have adapted over many years to thrive in the particular places where they live. Some animals that live in places where it is very snowy, like high in the mountains or in the arctic, end up white so that they fit in better. Animals and plants that live in the desert, like cacti and camels, have evolved so that they need only the very little water that they get living there. Now think of fish. They are able to swim and breathe perfectly in the water. But a fish would not do very well living in the middle of the desert. Similarly, if you took a big black bear from the forest and dropped it down in the middle of the ocean, it would not last long at all.

This is because a process called natural selection has been at work since not long after the earth first formed many billions of years ago. Natural selection allows animals that have traits suited to a particular environment to survive and produce offspring. Animals who are unable to adapt to changes in their environments die off. With this process constantly at work, nature produces all sorts of animals well-suited to where they are: giraffes with long necks to reach the leaves on the trees in Africa, bears that sleep through long winters where there's no food, and on and on.

The process of natural selection helps us to understand how many plants and animals became the way they are. Many times, life finds a way, no matter how harsh the environment.

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Name: _____ **Date:** _____

1. What is one reason people used to think that nothing could live deep down in the ocean?

A. There was no sunlight there.

B. Some bacteria make food from sulfur.

C. Europa has very large oceans.

D. Life is extremely adaptable.

2. What does this passage describe?

A. This passage describes the process of photosynthesis and all the plants that use it.

B. This passage describes the importance of camels to other animals living in the desert.

C. This passage describes life deep in the ocean and the process of natural selection.

D. This passage describes the formation and discovery of hydrothermal vents.

3. Read the following sentences: "Some animals that live in places where it is very snowy, like high in the mountains or in the arctic, end up white so that they fit in better. Animals and plants that live in the desert, like cacti and camels, have evolved so that they need only the very little water that they get living there."

What can be concluded from this information?

A. Animals are better suited to living in the desert than in places where it is very snowy.

B. Plants evolve more quickly than animals do.

C. Animals evolve more quickly than plants do.

D. Animals and plants change over time based on where they live.

4. What is a result of the discovery of life deep in the ocean?

A. Scientists realized that sulfur is poisonous to most living things on Earth.

B. Scientists realized that life can exist in places without sunlight and oxygen.

C. Scientists became confident that nothing could live around a hydrothermal vent.

D. Scientists learned that sunlight is necessary for the process of photosynthesis.

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5. What is the main idea of this passage?

A. For many years scientists thought that nothing could live near a hydrothermal vent.

B. Life is extremely adaptable and can be found even in harsh environments.

C. Some bacteria use sulfur to make food in a process known as chemosynthesis.

D. Scientists now think that life may exist on Europa, one of Jupiter's moons.

6. Read the following sentence: "All different kinds of places on Earth have animals and plants that have **adapted** over many years to thrive in the particular places where they live."

What does **adapted** mean in the sentence above?

A. changed

B. died

C. played

D. run away

7. Choose the answer that best completes the sentence below.

Scientists now know that life exists deep in the ocean around hydrothermal vents; _____, they thought that nothing could live there.

A. for example

B. therefore

C. previously

D. currently

8. According to the passage, why did scientists think that nothing could live around hydrothermal vents?

9. How did the bacteria and animals that scientists discovered around the hydrothermal vents get food?

10. Explain how the bacteria and animals around the hydrothermal vents showed scientists that life was much more adaptable than they had believed.

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Secrets of Survival: The Ancient Utah Juniper

by Mimi Jorling

Utah Juniper range map

Junipers are trees and shrubs in the genus *Juniperus*. They are in a class of trees called conifers, which means they have needle or scale-like leaves and their seeds and pollen are grown in cones. Other conifers are yews, spruce, and pine. They are mostly evergreen, meaning they do not lose their leaves, but stay green all year. Conifers you might be familiar with are the pines and spruces that are commonly used as Christmas trees. Different types of junipers grow all over the world. Humans have admired them and used their wood and berries for thousands of years.

The Utah Juniper (*Juniperus osteosperma*) is one of many types of junipers that grow in the western part of the United States, from Montana and Idaho through Nevada, California, Utah, and Colorado, and down to Arizona and New Mexico. Utah Junipers grow in very arid (dry) environments. They live on rocky slopes where there is not much rain. Strong winds blow, which can dry them out even more. The wind also sweeps away, or erodes, soil and pushes relentlessly against the juniper's trunk. Intense sunlight burns down on them as well, and reflects off surrounding rock. Despite all these challenges, juniper trees can grow to be very old! Their average lifespan is 400-750 years, and some get even older. For a plant to live such a long time, it must be very strong and well adapted to its

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environment.

Adaptations of Utah Juniper

In order to protect themselves from hot sun and drying wind, junipers have developed a waxy coating on their leaves and berries. This holds moisture in and keeps sunlight from scorching the leaves. (Juniper "berries" are grayish-blue and are actually fleshy cones.)

Juniper roots are also specialized to fit their environment. Junipers grow one root straight down. This is called a tap root. (A carrot is also a tap root-one that we eat.) The juniper's tap root can grow 40 feet straight down, and can push through crevices and rocks. This creates a strong anchor and allows the juniper to find water deep in the earth. The juniper also puts out lateral roots that grow just under the surface of the ground away from the tree. Lateral roots can grow up to 100 feet away from the tree. They also grab onto the soil, holding the tree in its place, and absorb shallow water from short rainfalls. These two different root systems provide insurance that should one system be damaged, the other will continue to grow.

The juniper also has the ability to shut down certain branches and route all nutrients to a few branches in order to keep growing. This is crucial in times of stress, such as drought, when there isn't enough water for the entire tree to survive.

The gnarled and twisting habit (the word "habit" used when talking about plants refers to their shape) of Utah Junipers gives an indication of their age. It is a result of wind pushing on them. The trunk continuously twists very, very slowly over time. Indeed, the tightly twisted trunks look ancient.

As difficult as these conditions sound, and as tough as junipers are, they do not live in these harsh environments by themselves. Many other plants and animals have found different ways to adapt as well. Shrubs, trees, flowers, and grasses, as well as birds and animals, live together in communities, supporting each other with food and shelter.

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Name: _____ **Date:** _____

1. What are junipers?

A. trees and shrubs

B. sand and gravel

C. rocks and minerals

D. flowers and vines

2. What does the author describe in the second paragraph?

A. similarities between Utah Junipers and Christmas trees

B. the environment of the Utah Juniper

C. the adaptations of the Utah Juniper

D. the animals that live in the same environment as the Utah Juniper

3. Read these sentences from the text:

"Juniper roots are also specialized to fit their environment. Junipers grow one root straight down. This is called a tap root. (A carrot is also a tap root-one that we eat.) The juniper's tap root can grow 40 feet straight down, and can push through crevices and rocks. This creates a strong anchor and allows the juniper to find water deep in the earth. The juniper also puts out lateral roots that grow just under the surface of the ground away from the tree. Lateral roots can grow up to 100 feet away from the tree. They also grab onto the soil, holding the tree in its place, and absorb shallow water from short rainfalls. These two different root systems provide insurance that should one system be damaged, the other will continue to grow."

Based on this evidence, what can you conclude about the importance of water to junipers?

A. Water is very important to junipers.

B. Water is not very important to junipers.

C. Water is not at all important to junipers.

D. Water is important to junipers in cold weather but not in hot weather.

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4. Read these sentences from the text:

"The gnarled and twisting habit (the word 'habit' used when talking about plants refers to their shape) of Utah Junipers gives an indication of their age. It is a result of wind pushing on them. The trunk continuously twists very, very slowly over time. Indeed, the tightly twisted trunks look ancient."

Based on this information, what can you infer about the connection between a Utah Juniper's trunk and its age?

A. The older a Utah Juniper is, the darker its trunk will be.

B. The younger a Utah Juniper is, the darker its trunk will be.

C. The younger a Utah Juniper is, the more tightly twisted its trunk will be.

D. The older a Utah Juniper is, the more tightly twisted its trunk will be.

5. What is the main idea of this text?

A. Different types of junipers grow all over the world.

B. Utah Junipers have developed a waxy coating on their leaves and berries.

C. A Utah Juniper's tap root can grow 40 feet straight down.

D. Utah Junipers are well adapted to their environment.

6. Read this sentence from the text:

"These two different root systems provide insurance that should one system be damaged, the other will continue to grow."

What does "provide insurance" probably mean here?

A. refund or give money back

B. nurse or take care of

C. guarantee or make sure

D. supply or provide with

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7. Read these sentences from the text:

"The juniper also has the ability to shut down certain branches and route all nutrients to a few branches in order to keep growing. This is crucial in times of stress, such as drought, when there isn't enough water for the entire tree to survive."

What word or phrase could best replace "such as" in the second sentence?

A. before
B. instead of
C. particularly
D. in the end

8. Describe the environment of Utah Junipers.

Include at least three pieces of information from the text in your answer.

9. What is one adaptation that Utah Junipers have made to their environment?

Support your answer with evidence from the text.

10. Explain whether Utah Junipers are well adapted to their environment.

Support your answer with evidence from the text.

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Plant Diversity

What is a plant?

Read to Learn

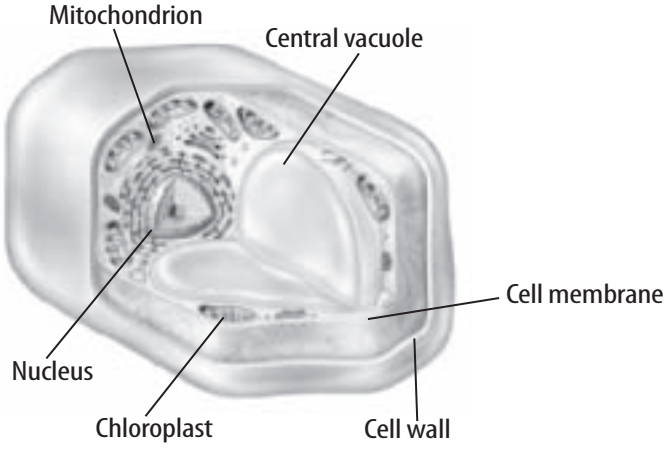
Characteristics of Plants

Plants are an important part of life on Earth. As you read this lesson, look for the characteristics that make plants so important to other organisms.

Cell Structure

Plants are made of eukaryotic cells, which have membrane-bound organelles. A plant cell's organelles are shown in the figure below. A plant cell differs from an animal cell because it has chloroplasts and a cell wall. Chloroplasts convert light energy to chemical energy. The cell wall provides support and protection. A mature plant cell also has one or two vacuoles that store a watery liquid called sap.

Plant Cell Structure



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Multicellular

Plants are multicellular. This means they are made of many cells. The cells carry out specialized functions and work together to keep the plant alive. Some plants, such as the reproductive stage of some ferns, are microscopic. Other plants, such as redwood trees, are some of the largest organisms on Earth.

Producers

Organisms that use an outside energy source, such as the Sun, to make their own food are called **producers.** Plants are producers. Plants make their own food, a simple sugar called glucose, during a process called photosynthesis. All other organisms rely on producers, either directly or indirectly, for their sources of food.

Plant Adaptations

Millions of years ago, no land plants existed. Scientists hypothesize that present-day land plants and green algae evolved from a common ancestor. They base their hypothesis on chemical similarities between green algae and plants. Green algae and land plants have some of the same kind of pigments. DNA similarities are also found between these two groups of organisms.

The first land plants probably lived in moist areas. Life on land would have provided some advantages to plants. Plenty of sunlight would have been available for photosynthesis to occur. The air that surrounded those plants would have been a mixture of gases, including carbon dioxide. Carbon dioxide is needed for photosynthesis. As land plants became more abundant, the amount of oxygen in the atmosphere increased because oxygen is a product of photosynthesis.

Plant species also had to adapt to survive without being surrounded by water. Many of the characteristics we now see in plants are adaptations to life on land.

Protection

One advantage to life on land is a constant supply of air that contains carbon dioxide. Carbon dioxide is needed for photosynthesis. Many plants have *a waxy, protective layer called the* **cuticle** *on their leaves, stems, and flowers***.** The cuticle is made of a waxy substance that is secreted by the cells. Its waxy nature slows the evaporation of water from a plant's surface. This covering also provides some protection from insects that might harm a plant's tissues.

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Support

The water that surrounds aquatic plants supports them. Land plants support themselves. Like all cells, a plant cell has a cell membrane. Recall that a rigid cell wall surrounds the cell membrane in a plant cell. The cell wall provides support and is made of cellulose. **Cellulose** *is an organic compound made of chains of glucose molecules.*

Many land plants also produce a chemical compound called lignin (LIG nun). Lignin strengthens cellulose in the cell walls and makes the walls more rigid. The combined strength of all of a plant's cell walls provides support for the plant. Wood is mostly made of cellulose and lignin.

Transporting Materials

In order for a plant to survive, water and nutrients must move throughout its tissues. In some plants, such as mosses, these materials move from cell to cell by the processes of osmosis and diffusion. This means that water and other materials dissolved in water move from areas of a plant where they are more concentrated to areas where they are less concentrated.

Other plants, such as grasses and trees, have specialized tissues called vascular tissue. **Vascular tissue** *is composed of tubelike cells that transport water and nutrients in some plants.* Vascular tissue can carry materials over great distances throughout a plant. Material can travel up to hundreds of meters.

Reproduction

Water carries the reproductive cells of aquatic plants from plant to plant. Adaptations in land plants enable them to reproduce in other ways.

Some plants have water-resistant seeds or spores that are part of their reproductive process. Seeds and spores move throughout environments in different ways. Animals transport seeds, and environmental factors such as wind and water move seeds from place to place. For example, burrs containing seeds may cling to a dog's fur, the wind carries milkweed seeds, and coconut seeds float in water.

Plant Classification

Recall that kingdoms such as the animal kingdom consist of smaller groups called phyla. Members of the plant kingdom are organized into groups called divisions instead of phyla. Like all organisms, each plant has a two-word scientific name. For example, the scientific name for a red oak is *Quercus rubra*.

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Seedless Plants

Liverworts and mosses reproduce by structures called spores. Plants that reproduce by spores often are called seedless plants.

Seedless plants do not have flowers. Some seedless plants do not have vascular tissue and are called nonvascular plants. Other seedless plants, such as ferns, have vascular tissue and are called vascular plants. Seedless plants are classified into several divisions.

Seed Plants

Most of the plants around you—such as pine trees, grasses, petunias, and oak trees—are seed plants. Almost all the plants we use for food are seed plants.

Some seed plants have flowers that produce fruit with one or more seeds. Others, such as pine trees, produce their seeds in cones. Each seed has tissues that surround, nourish, and protect the tiny plant embryo inside it. It is thought that all present-day land plants originated from a common ancestor, an ancient green algae.

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Lesson Outline

LESSON 1

What is a plant?

A. Characteristics of Plants

1. Plants are made of _____ cells, which have membrane-bound _____.

a. Unlike animal cells, plant cells have _____ and a cell _____.

b. Light energy is converted into chemical energy by _____.

2. Plants are _____, which means they are made of many cells.

3. Some plants are some of the largest organisms on Earth, and others are _____.

4. Organisms that use an outside energy source such as the Sun to make their own food are called _____.

a. Plants make their own food during a process called _____.

b. All organisms depend on _____ directly or indirectly for food.

B. Plant Adaptations

1. Present-day land plants and green algae are thought to have evolved from a common _____.

2. The first land plants probably lived in _____ areas with plenty of sunlight and carbon dioxide.

3. As more plants lived on land, the amount of oxygen in the atmosphere _____ because oxygen is a product of _____.

4. Many plants have a waxy, protective layer on their leaves, stems, and flowers called the _____.

a. The cuticle is made of a waxy substance that slows the _____ of water from the plant's surface.

b. The cuticle also protects the plant from _____ that might damage its _____.

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Lesson Outline continued

5. _____ plants are supported by the water that surrounds them, whereas _____ plants must provide their own support.

6. Water and _____ must move through a plant's _____ for a plant to survive.

a. In mosses, water and nutrients can move from cell to cell by _____ and osmosis.

b. Grasses and trees have _____ tissue, which is composed of tubelike cells that transport water and nutrients.

7. Water carries the reproductive cells of _____ plants from plant to plant.

8. Some land plants have water-resistant seeds or _____ that move through the environment via animals, _____, and water.

C. Plant Classification

1. Members of the plant kingdom are organized into groups called _____ instead of phyla.

2. Plants that reproduce by _____ such as liverworts and mosses are called seedless plants.

a. Some seedless plants do not have vascular tissue and are called _____ plants.

b. Ferns and other seedless plants do have vascular tissues and are called _____ plants.

3. Most familiar plants, including those that are used for food, are _____ plants.

a. Some seed plants have _____ that produce _____ with one or more seeds.

b. Pines trees produce their seeds in _____.

c. Seeds contain a tiny plant _____ surrounded by _____ that nourish and protect it.

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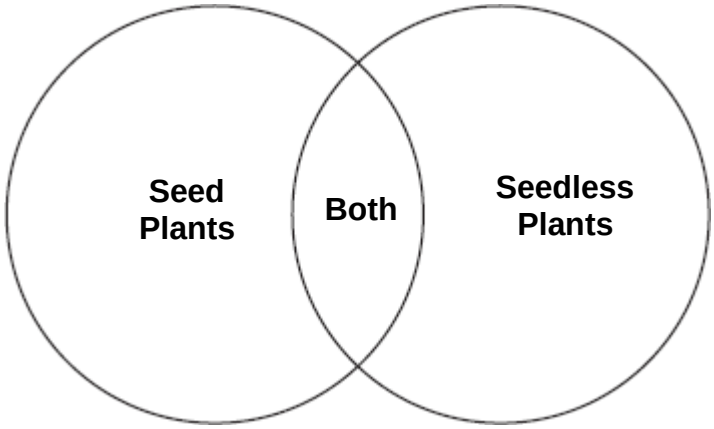
Content Practice A

LESSON 1

What is a plant?

Directions: *Put a check mark in the column that describes each plant characteristic or adaptation.*



	Seed Plants	Seedless Plants	Both
1. They use vascular tissue to move nutrients through the plant.			
2. They produce flowers.			
3. They produce spores.			
4. They evolved from ancient green algae.			
5. They disperse seeds through the wind.			
6. They produce cones.			
7. They have cell walls made of cellulose.			
8. They have a waxy coating called cuticle.			
9. They are multicellular.			
10. They use photosynthesis to make food.			
11. They produce oxygen.			

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Content Practice B

LESSON 1

What is a plant?

Directions: *Complete the chart by writing two facts for each plant characteristic and adaptation.*

Characteristics of Plants	**1.** cell structure	• •
	2. multicellular	• •
	3. producers	• •
Plant Adaptations	**4.** protection	• •
	5. support	• •
	6. transporting materials	• •
	7. reproduction	• •

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Text-Analysis Activity: Adjectives and Nouns

Adjectives and nouns are two main parts of speech. A noun is a person, place, thing, or idea. An adjective describes and modifies a noun.

Directions: *On each line, write the adjective that correctly completes each sentence.*

simple	**rigid**	**mature**	**eukaryotic**
tiny	**important**	**organic**	

1. Plants and animals share some characteristics but differ in many _____ ways.

2. Plants are made up of _____ cells, and animals are also made of these cells.

3. These cells contain _____ structures called organelles.

4. Some organelles appear in the cells of plants and animals. Others, like chloroplasts, are found in plant cells but not animal cells. Another organelle called a vacuole is found in _____ plant cells but not in animal cells.

5. Finally, a(n) _____ cell wall surrounds plant cells but not animal cells.

6. The cell wall is made of a(n) _____ compound called cellulose.

7. This structural molecule is made up of chains of the _____ sugar glucose.

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School to Home **LESSON 1**

What is a plant?

Directions: *Use your textbook to respond to each statement.*

1. **Plants are a diverse kingdom of organisms.**

   Compare and **contrast** the organelles in the cells of plants and animals.

2. **Plants are important to all organisms on Earth.**

   Name the process that makes plants essential to all life-forms and describe why it is important.

3. **Over time, adaptations enabled plants to live on land rather than in water.**

   Describe the adaptations that enable plants to survive on land.

4. **Plants are classified according to similar characteristics.**

   List the basic characteristics that determine how plants are categorized for classification.

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Key Concept Builder

LESSON 1

What is a plant?

Key Concept What characteristics are common to all plants?

Directions: *Answer each question or respond to each statement on the lines provided.*

1. All plants are made from eukaryotic cells. What is special about a eukaryotic cell?

_____

2. List two ways a plant cell differs from an animal cell.

_____

3. Why are chloroplasts important for the survival of plant cells?

_____

4. List two functions of cell walls found in plants.

_____

5. What function do vacuoles serve in plant cells?

_____

6. Why is it an advantage for plants to be multicellular?

_____

_____

7. Why are plants considered producers?

_____

_____

8. Why are plants, as producers, important to all other organisms?

_____

_____

9. What food source is made during photosynthesis?

_____

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Key Concept Builder

LESSON 1

What is a plant?

Key Concept What adaptations have enabled plant species to survive Earth's changing environments?

Directions: *On the line before each statement, write the letter of the term that matches it correctly. Some terms may be used more than once.*

_____ **1.** Materials move from cell to cell by osmosis.

_____ **2.** Seeds are carried by the wind.

_____ **3.** There is a cuticle on leaves, stems, and flowers.

_____ **4.** The cell wall surrounds the cell membrane.

_____ **5.** Lignin makes cellulose more rigid.

_____ **6.** Seeds float in water.

_____ **7.** The cell wall is made of cellulose.

_____ **8.** The waxy substance on leaves slows evaporation.

_____ **9.** Water and nutrients are carried through vascular tissue.

_____ **10.** Seeds cling to the fur of animals.

_____ **11.** Materials move from areas of high to low concentration.

Adaptations

A. protection

B. support

C. transporting materials

D. reproduction

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Key Concept Builder

LESSON 1

What is a plant?

Key Concept What adaptations have enabled plant species to survive Earth's changing environments?

Directions: *Answer each question in the space provided.*

Question	Answer
1. What chemical similarities have been found between land plants and green algae?	
2. What type of environment did the first land plants probably live in?	
3. What were two advantages of life on land for the first land plants?	
4. What benefit did land plants offer as they became more abundant?	
5. How does the cuticle protect plants if the climate suddenly becomes hotter or drier?	
6. How do cellulose and lignin give plants support during an unusually windy season?	
7. What are three ways land plants disperse seeds as part of the reproductive process? How do you think this helps plants survive in changing environments?	

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Key Concept Builder

LESSON 1

What is a plant?

Key Concept How are plants classified?

Directions: *On the line before each statement, write* T *if the statement is true or* F *if the statement is false. If the statement is false, change the underlined word(s) to make it true. Write your changes on the lines provided.*

_____ **1.** Members of the plant kingdom are organized into divisions.
_____

_____ **2.** Most plants around you are seedless plants._____

_____ **3.** Nonvascular plants are plants that lack spores._____

_____ **4.** Liverworts are a type of seedless plant._____

_____ **5.** Inside each seed is a tiny plant embryo._____

_____ **6.** Oak trees and grasses are examples of seed plants._____

_____ **7.** Scientists believe lichen is the common ancestor for all plants.
_____

_____ **8.** Every plant has a two-word scientific name._____

_____ **9.** An example of a seed plant is one that reproduces by spores.
_____

_____ **10.** All seedless plants lack flowers._____

_____ **11.** Ferns are an example of a vascular seedless plant._____

_____ **12.** Most plants used for food are seed plants._____

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Enrichment

LESSON 1

The "Dinosaur" Tree

Imagine what it was like being the person to discover a living thing thought to have been extinct for more than two million years. Suppose it went something like this ...

An Avid Bushwalker

My name is *David Noble*, and I am a field officer in Australia with the National Parks and Wildlife Services (New South Wales). One September day in 1994 was a memorable one for me.

On a cool day in June, I was hiking with friends in the Wollemi National Park some 150 miles from Sydney. Within this enormous park are about 500 deeply water-carved gorges. It is difficult to reach the floor of any of them without rappelling in and hoisting out. That June, we heaved over rock ledges and slid on our ropes to the floor of a canyon to view the temperate rain forest from below the canopy. Marking the spot, we vowed to return to this same spot on our next trip.

That Fateful Day

On September 10, 1994, my mates and I hiked to that gorge marked on our map. This time we headed in from the other end of the gorge to survey a different landscape that was previously unseen and unexplored.

I expected to see the usual sassafras, coachwood, ferns, and orchids. Instead, I was looking at strange trees I had never seen before. These trees had bark like bubbly chocolate and soft, flat, bladelike needles. I took fallen samples for analysis.

An Astounding Discovery

The next month, I returned to the canyon with an experienced naturalist who recognized the samples as being from a plant thought to be extinct for two million years. There was a small, well-protected stand of 23 of these amazing pine trees in this remote gorge—and they had been there for millions of years. The tree was named *Wollemia nobilis*, for the park and, incredibly, for me!

An Undisclosed Location

To protect these trees in the wild, their precise location is known only to a few scientists, and the area is closed to the public. However, the seeds are being cultivated and small saplings can be ordered for your garden. Commercial propagation is part of the strategy to increase their number. Although their number in the wild remains small, they grow well when they are cultivated.

Applying Critical-Thinking Skills

Directions: *Answer each question.*

1. **Predict** What might have happened to these unique and rare trees if David Noble and his hiking friends had not taken the path from the opposite side of the gorge on that day in September 1994? What did Noble's discovery make possible for the Wollemi pines?

2. **Infer** Why do you think the precise location of the stand of Wollemi pine trees is kept secret and that it is closed to the public?

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Lesson Quiz A

LESSON 1

What is a plant?

True or False

Directions: *On the line before each question or statement, write* T *if the statement is true or* F *if the statement is false. If the statement is false, change the underlined word(s) to make it true. Write your changes on the lines provided.*

_____ **1.** A mature plant cell contains one or two <u>chloroplasts</u> that store a watery liquid called sap.

_____

_____ **2.** As land plants became more abundant, the amount of <u>carbon dioxide</u> in the atmosphere increased due to photosynthesis.

_____

_____ **3.** Some land plants developed water-resistant seeds or spores as part of their <u>reproductive</u> process.

_____

_____ **4.** Members of the plant kingdom are organized into groups called <u>phyla</u>.

_____

_____ **5.** Most of the plants around you are <u>seed</u> plants.

_____

Completion

Directions: *On each line, write the term from the word bank that correctly completes each sentence. Each term is used only once.*

cell wall **cellulose** **cuticle** **producer** **vascular tissue**

6. _____ is made up of tubelike cells.

7. Chains of glucose molecules form _____.

8. A _____ provides structural support and protection.

9. The waxy nature of a _____ prevents water from escaping from the surface of a leaf.

10. A _____ makes food for itself and other organisms.

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Name _____ Date _____ Class _____

Lesson Quiz B

LESSON 1

What is a plant?

Short Answer

Directions: *Answer each question or respond to each statement on the lines provided.*

1. **Draw** a diagram of a typical plant cell and label the structures it contains.

2. **Describe** some of the adaptations of plants that enabled them to eventually live on land.

_____

_____

_____

3. **Explain** how members of the plant kingdom are classified.

_____

_____

_____

Completion

Directions: *On each line, write the term that correctly completes each sentence.*

4. _____ is made up of tubelike cells.

5. Chains of glucose molecules form _____.

6. A(n) _____provides structural support and protection.

7. The waxy nature of a(n) _____ prevents water from escaping from the surface of a leaf.

8. A(n) _____ makes food for itself and other organisms.

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Plant Diversity

Seed Plants

Read to Learn

Characteristics of Seed Plants

Have you ever eaten corn, beans, peanuts, peas, or pine nuts? These foods are edible seeds. Seeds are the plant parts that are most important to humans as a source of food. Recall that a seed contains a tiny plant embryo and nutrition for the embryo to begin growing. More than 300,000 species of seed plants exist.

Seed plants are organized into two groups. Cone-bearing seed plants are called gymnosperms (JIHM nuh spurmz). The second group is flowering seed plants, which are called angiosperms (AN gee uh spurmz).

All seed plants have vascular tissue that transports water and nutrients throughout the plant. This means they also have roots, stems, and leaves. You will read more about the characteristics of seed plants in this lesson.

Vascular Tissue

All seed plants contain vascular tissues in their roots, stems, and leaves. This tissue transports water and nutrients throughout a plant.

The two types of vascular tissue are xylem (ZI lum) and phloem (FLOH em). *The* **cambium** *is a layer of tissue that produces new vascular tissue and grows between xylem and phloem*.

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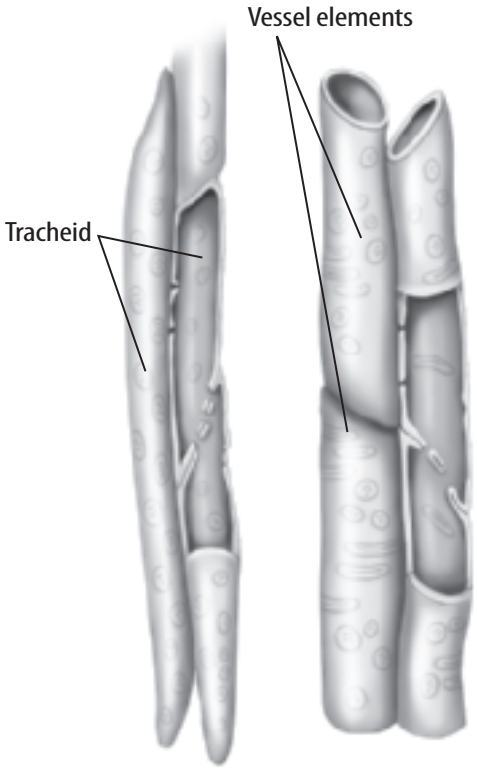
Xylem *One type of vascular tissue—***xylem***—carries water and dissolved nutrients from the roots to the stem and the leaves*. Some xylem cells have thickened cell walls that help support the plant.

Two kinds of xylem cells are tracheids (TRAY kee udz) and vessel elements. The xylem of all vascular plants is made of tracheid cells.

Xylem Cells



As shown in the figure to the right, tracheid cells are long and narrow with tapered ends. The cells grow end-to-end and form a strawlike tube. Water passes through openings in the end wall of each cell. Tracheid cells die at maturity, leaving a hollow tube. This enables water to flow freely through them.

The xylem in flowering plants also includes a type of cell called a vessel element. The diameter of a vessel element is larger than that of a tracheid. The end walls of vessel elements have large openings where water can pass through, as shown in the figure above. In some vessel elements, the end walls are completely open. Because of these large openings, vessel elements are more efficient at transporting water than are tracheids.

Phloem *Another type of vascular tissue—***phloem***—carries dissolved sugars throughout a plant*. Phloem is made up of two types of cells. These are sieve-tube elements and companion cells.

Sieve-tube elements are specialized phloem cells. These long, thin cells are stacked end-to-end and form long tubes. The end walls have holes in them. A sieve-tube element contains cytoplasm but does not have a nucleus, mitochondria, or ribosomes.

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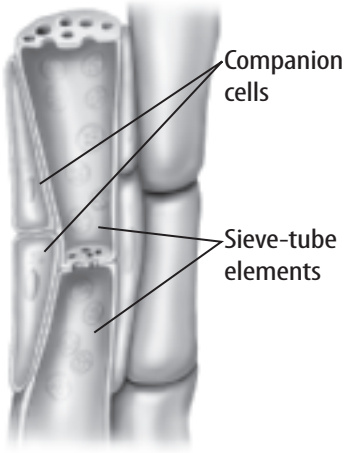
Phloem



Each sieve-tube element has a companion cell next to it. A companion cell does contain a nucleus. A companion cell helps control the functions of the sieve-tube element. Companion cells and sieve-tube elements are shown in the figure above.

Roots

Roots are important to a plant's survival.

- Roots anchor a plant, either in soil or onto another plant or object such as a rock. Roots help the plant stay upright.
- Root systems of plants absorb water and other substances from the soil.
- Plants such as radishes and carrots store food in their roots. This food can be used to grow new plant tissues after a dry period or a cold season.

Stems

The stem connects a plant's roots to its leaves. Some plants, like trees, have stems that are easy to see. Other plants, like the potato and iris, have underground stems that are often mistaken for roots. Stems support branches and leaves. Their vascular tissues transport water, minerals, and food. Xylem carries water and minerals from the roots to the leaves. The sugar that a plant produces during photosynthesis flows through a stem's phloem to all parts of the plant. Another important function of stems is the production of new cells for growth. Only certain regions of a stem produce new cells.

Plant stems are classified as either woody or herbaceous. Woody stems are stiff and typically not green, like those of trees. Herbaceous stems usually are soft and green.

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Leaves

Leaves come in many shapes and sizes. Most leaves have an important function in common—they are the main location for photosynthesis in the plant. They capture light energy and convert it to chemical energy. This is how leaves make the plant's food.

Most leaves are made of layers of cells, as shown in the figure below. The top and bottom layers of a leaf are made of epidermal (eh puh DUR mul) tissue. Epidermal cell walls are transparent, and light passes through them easily. These cells produce a waxy outer layer called the cuticle. The cuticle helps reduce the amount of water that evaporates from a leaf.

Most leaves have small openings in the epidermis called **stomata** (STOH muh tuh; singular, stoma). When the stomata open, carbon dioxide, oxygen, and water vapor can pass through them. Two guard cells surround each stoma and control its size.

Rows of palisade (pa luh SAYD) mesophyll (MEH zuh fil) cells are below the upper epidermis. These cells are tightly packed. Photosynthesis mainly occurs in these cells.

Under the palisade mesophyll cells is the spongy mesophyll layer. The arrangement of these cells enables gases to diffuse throughout a leaf. A leaf's xylem and phloem transport materials throughout the leaf.

Angiosperm and gymnosperm leaves each have some unique characteristics. An angiosperm leaf tends to be flat with a broad surface area. A gymnosperm leaf is usually needlelike or scalelike and often has a thick cuticle. This characteristic benefits gymnosperms that grow in drier areas. The thick cuticle helps conserve water.

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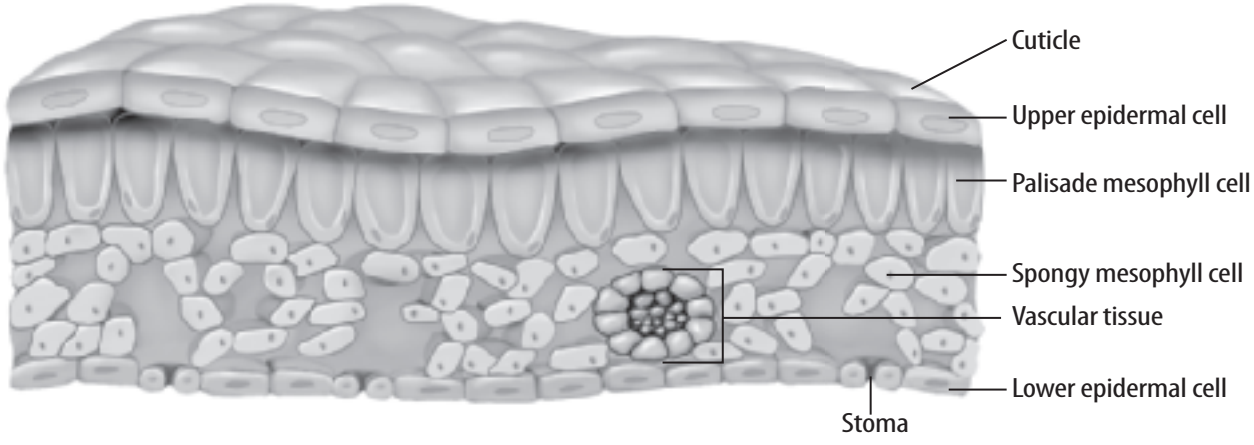
Leaf Cross Section



Gymnosperms

In a gymnosperm, the seeds are produced in a cone. Gymnosperms include the oldest plant (the bristlecone pine at 4,900 years old); the tallest plant (the coast redwood that can grow to 115 m); and perhaps Earth's largest organism (the sequoia). Gymnosperms include some familiar conifers such as spruces, pines, and redwoods. You might not be as familiar with some other types of gymnosperms, such as cycads, ginkgoes, and gnetophytes.

Conifers grow on all continents except Antarctica. Cycads usually grow in tropical regions. Although cycads might look like ferns, they are seed plants. DNA evidence has shown that they are closely related to other gymnosperms. One gymnosperm group has only one species—ginkgo. Ginkgoes have broad leaves and are popular as ornamental trees in urban areas. The gnetophytes (NEE tuh fites) are an unusual and diverse group of gymnosperms.

Humans use gymnosperms in a variety of ways, including as building materials; in paper production; as medicines; and as ornamental plants in gardens, along streets, and in parks.

Angiosperms

More than 260,000 species of flowering plants, or angiosperms, exist. Angiosperms began to thrive about 80 million years ago. Angiosperms grow in a variety of habitats, from deserts to the tundra.

Almost all of the food eaten by humans comes from angiosperms or from animals that eat angiosperms. Grains, vegetables, herbs, and spices are just a few examples of foods that come from angiosperms. Many other items, such as clothing, medicines, and building materials, also come from these plants.

Flowers

Angiosperms produce seeds that are part of a fruit. This fruit grows from parts of a flower after pollination and fertilization.

All angiosperms produce flowers. Some flowers, such as tulips and roses, are beautiful and showy. You also might be familiar with other flowers, such as dandelions, because you have seen them growing in your neighborhood. However, some plants produce flowers that you might never have noticed. For example, grass flowers are tiny and not easily seen.

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Annuals, Biennials, and Perennials

Annuals Plants that grow, flower, and produce seeds in one growing season are called annuals. After one growing season, the plants die. Tomatoes, beans, pansies, and many common weeds are annuals.

Biennials Plants that complete their life cycles in two growing seasons are called biennials. During the first year, the plant grows roots, stems, and leaves. The part of the plant that is above ground might become dormant during the winter months. In the second growing season, the plant produces new stems and leaves. It flowers and produces seeds during this second growing season. After flowering and producing seeds, the plant dies. Carrots, beets, and foxglove are biennials.

Perennials Plants that can live for more than two growing seasons are called perennials. Trees and shrubs are perennials. The leaves and stems of some herbaceous perennial plants die in the winter. Stored food in the roots is used each spring to produce new growth.

Monocots and Dicots

Flowering plants traditionally have been organized into two groups—monocots and dicots. These groups are based on the number of leaves in early development, or cotyledons (kah tuh LEE dunz), in a seed. Researchers have learned that dicots can be organized further into two groups based on the structure of their pollen. However, because these two groups of dicots share many characteristics, we will continue to refer to them all as dicots. The table below shows some of the differences between monocots and dicots.

Monocots and Dicots

Structure	Monocots	Dicots
Leaves	narrow with parallel veins	branched veins
Flowers	flower parts in multiples of three	flower parts in multiples of four or five
Stems	vascular tissue in bundles scattered throughout the stem	vascular tissue in bundles in rings
Seeds	one cotyledon	two cotyledons

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Content Vocabulary

LESSON 3

Seed Plants

Directions: *Complete the table with information about each term listed below.*

cambium **phloem** **stoma** **tissue** **xylem**

Structure	Location Within Plant	Function
1.	**2.**	transports water and nutrients from the roots to the rest of the plant
phloem	**3.**	**4.**
5.	between the xylem and phloem	**6.**
7.	depends on the particular type; throughout the plant	**8.**
stoma	**9.**	**10.**

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Lesson Outline

LESSON 3

Seed Plants

A. Characteristics of Seed Plants

1. A seed contains a tiny plant _____ and _____ that the embryo uses to grow.

2. There are two main groups of seed plants: _____, or cone-bearing seed plants, and _____, or flowering seed plants.

3. All seed plants contain _____ tissues in their _____, stems, and leaves.

a. The two types of vascular tissue are _____ and _____.

b. _____ is a type of vascular tissue that carries water and _____ nutrients from the roots to the stem and the leaves.

c. _____ is a type of vascular tissue that carries dissolved sugars throughout a plant.

4. _____ anchor a plant, either in _____or onto another plant or an object such as a rock.

a. Root systems help plants stay upright and absorb _____ and other substances from soil.

b. Some plants, including radishes and carrots, store _____ in their roots.

5. The _____ connects a plant's roots to its leaves.

a. The _____ in stems carries water and minerals from the _____ to the leaves.

b. _____ made during photosynthesis flows through the _____ in stems to the rest of a plant.

6. Although they have different shapes and sizes, most leaves are the main site of _____ in a plant.

a. Leaves capture light energy and convert it to chemical energy, thus providing the plant's _____.

b. _____ leaves tend to be flat with a broad surface area.

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Lesson Outline continued

c. _____ leaves are usually needlelike or scalelike with a thick _____.

B. Gymnosperms

1. The seeds of gymnosperms are produced in a(n) _____.
2. Gymnosperms include _____, cycads, ginkgoes, and gnetophytes.
3. Conifers grow on all the world's continents except _____.
4. Gymnosperms are used for building materials, paper, medicines, and as _____ plants.

C. Angiosperms

1. _____ plants, or angiosperms, grow in many habitats, from deserts to the tundra.
2. Almost all the _____ eaten by humans comes from angiosperms or from animals that eat angiosperms.
3. Angiosperms produce seeds that are part of a(n) _____ that grows from parts of a flower.
4. Plants that grow, flower, and produce seeds in one growing season are called _____.
5. _____ are plants that complete their life cycles in two growing seasons.
6. _____ plants such as trees can live for more than two growing seasons.
7. Monocots and dicots differ in leaf, flower, stem, and _____ structure.
8. _____ have seeds with one cotyledon, and _____ have seeds with two cotyledons.

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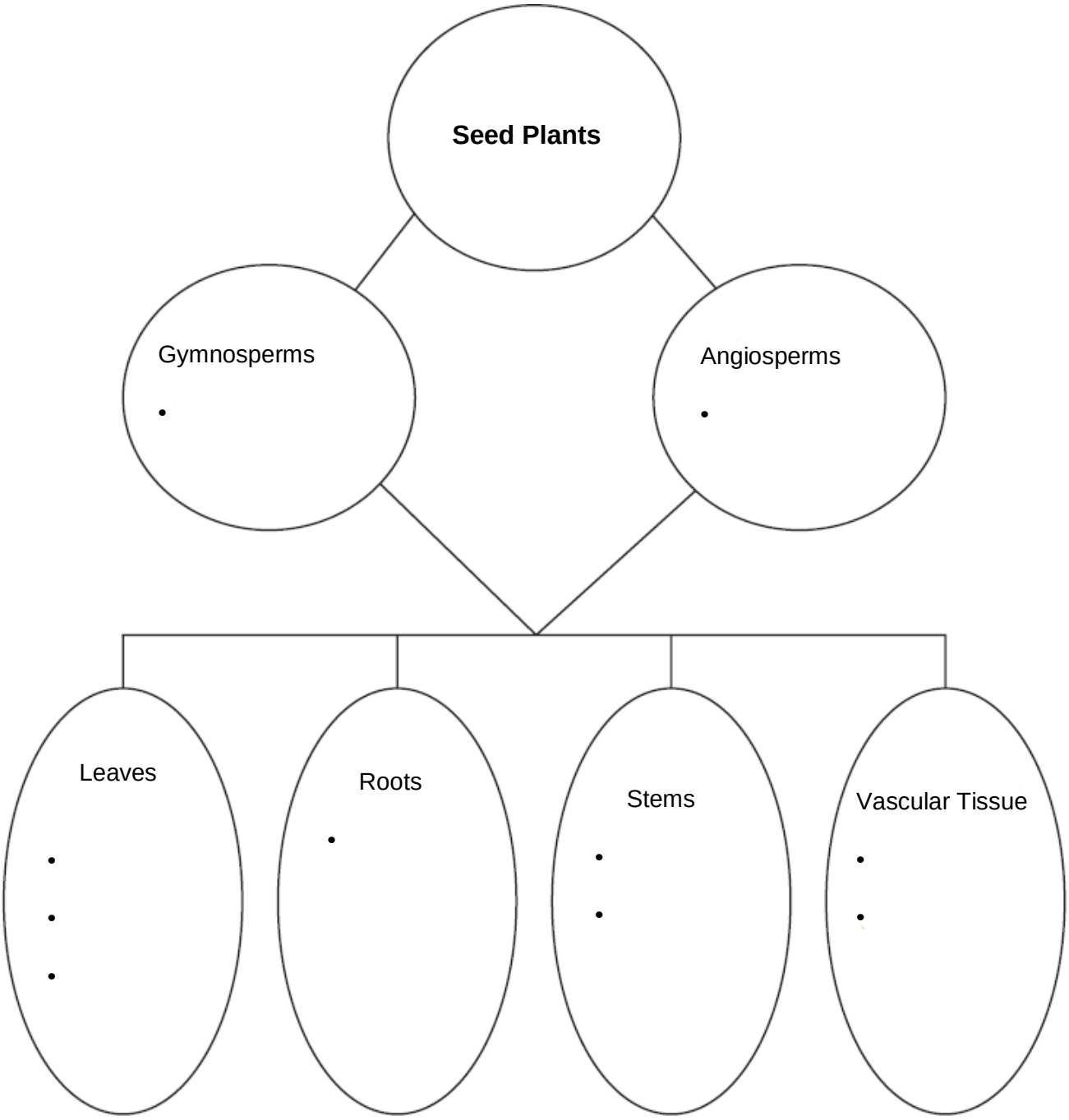
Content Practice A

LESSON 3

Seed Plants

Directions: *Complete the concept web by writing the correct term from the word bank after each bullet. Each term is used only once.*

cone-bearing	**epidermis cells**	**flowering**	**herbaceous**
palisade mesophyll cells	**phloem**	**Stomata**	**woody**
xylem	**absorption**		



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Content Practice B

LESSON 3

Seed Plants

Directions: *On the line before each statement, write* T *if the statement is true or* F *if the statement is false. If the statement is false, change the underlined word(s) to make it true. Write your changes on the lines provided.*

_____ **1.** Vascular tissue is found in roots, stems, and leaves. _____

_____ **2.** Roots anchor a plant and produce sugar. _____

_____ **3.** Two types of stems are herbaceous and flexible. _____

_____ **4.** Some plants have underground leaves that are often mistaken for roots.

_____

_____ **5.** Xylem carries water and dissolved nutrients from leaves to the stems.

_____

_____ **6.** Leaves are the major site of photosynthesis. _____

_____ **7.** The function of the cuticle is to increase evaporation of water from the leaves.

_____

_____ **8.** When a leaf's upper epidermal cells open, carbon dioxide, oxygen, and water vapor escape. _____

_____ **9.** A thick cuticle helps gymnosperms survive in dry climates.

_____

_____ **10.** The seeds of angiosperms are found inside cones. _____

_____ **11.** The seeds of gymnosperms are part of a fruit. _____

_____ **12.** Perennials complete their life cycle in two growing seasons.

_____

_____ **13.** Two types of flowering plants are dicots and monocots.

_____

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School to Home **LESSON 3**

Seed Plants

Directions: *Use your textbook to respond to each statement.*

1. **A seed plant produces seeds for reproduction.**

   List the characteristics shared by all seed plants.

2. **Seed plants are useful to humans and other organisms.**

   Describe some of the ways that humans and other organisms depend on seed plants.

3. **Seed plants are classified as gymnosperms or angiosperms.**

   Compare and **contrast** the characteristics of gymnosperms and angiosperms.

4. **Flowering plants are monocots or dicots.**

   Explain how someone could tell the difference between a monocot and dicot by observation.

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Key Concept Builder

LESSON 3

Seed Plants

Key Concept What characteristics are common to seed plants?

Directions: *Label these diagrams by writing the correct term from the word bank on each line. Each term is used only once.*

companion cells **sieve-tube elements** **tracheid** **vessel elements**

Xylem

1. _____

2. _____

Phloem

3. _____

4. _____

5. What is the function of xylem?

_____

6. What is the function of phloem?

_____

7. What are four functions of roots?

_____

_____

_____

8. What are three functions of stems?

_____

_____

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Key Concept Builder **LESSON 3**

Seed Plants

Key Concept How do other organisms depend on seed plants?

Directions: *Answer each question or respond to each statement on the lines provided.*

1. Photosynthesis occurs mainly in cells that make up the palisade mesophyll layer. Why is photosynthesis important to other organisms?

_____

2. How do stomata assist the process of photosynthesis needed by other organisms?

_____

3. Along with photosynthesis, how else do organisms depend on leaves found on seed plants?

_____

4. How might birds depend on conifer plants?

_____

5. How might small forest animals depend on angiosperms?

_____

6. **Identify** four ways humans rely on gymnosperms.

_____ _____

_____ _____

7. **Identify** how angiosperms benefit humans.

_____

_____

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Key Concept Builder **LESSON 3**

Seed Plants

Key Concept How are gymnosperms and angiosperms alike, and how are they different?

Directions: *Put a check mark in the column that each characteristic describes. Some columns may have both columns checked.*

	Gymnosperms	Angiosperms
1. have photosynthetic cells		
2. have seeds produced in cones		
3. have flowers		
4. have a type of vascular tissue called xylem		
5. have a root system		
6. have supporting stems		
7. most have a flat, broad leaf surface		
8. produce seeds without surrounding fruits		
9. produce seeds within a flower		
10. have leaves		
11. often have a thick cuticle		

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Key Concept Builder

LESSON 3

Seed Plants

Key Concept What adaptations of flowering plants enable them to survive in diverse environments?

Directions: *On the line before each description, write the letter of the term that matches it correctly. Some terms may be used more than once.*

_____ **1.** These have life cycles in two growing seasons.

_____ **2.** Plants die after one season.

_____ **3.** Plants store food in roots for new season growth.

_____ **4.** Plants produce seeds during second growing season.

_____ **5.** Flowers and seeds are produced in one season.

_____ **6.** Seeds have one cotyledon.

_____ **7.** Plants live for more than two growing seasons.

_____ **8.** Veins of leaves are branched.

A. annuals

B. biennials

C. perennials

D. dicots

E. monocots

Directions: *Answer the question on the lines provided.*

9. Why do you think the adaptations of flowering plants enable them to survive in diverse environments? Explain your answer.

_____

_____

_____

_____

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Enrichment **LESSON 3**

Rescuing Endangered Plants

Did you know that many plants in the United States are endangered? More than one in ten native plants are at risk. Currently, more than 750 species of plants in the United States are officially listed by the U.S. Fish and Wildlife Service as endangered or threatened.

Borrowing from Native Plants

One reason scientists want to save native plants, or wild species, is for their potential use in crossbreeding. Most North American food crops were brought here by European settlers. These foods aren't native to North America and often are not resistant to diseases and pests that are common here.

If a food crop, such as potatoes, is threatened by a disease, scientists can turn to the wild species for traits that make it naturally disease resistant. They can crossbreed the potato with a native plant to get a type of potato that is more resistant. Crossbreeding commercial crops with native plant crops also can produce plants that are not as susceptible to insects. This allows farmers to rely more on organic farming, or farming without pesticides.

One plant that grows in the United States that is becoming extinct is the wild rice plant. The wild rice plant lives on the bank of a single stream in Texas. Botanists are interested in this particular plant because it can survive drier and hotter conditions than most other types of rice plants. Such traits might be needed if Earth's average temperature continues to increase.

Another threat to native plants is the spread of genetically engineered crops. The crops, called biotech crops, are genetically altered to be resistant to insects, diseases, and fungi. If the seeds from the biotech crops pollinate with other plants, such as weeds that surround the crop fields, the weeds could become even more aggressive and threaten fragile native species. In one study, wind-carried pollen caused biotech seeds to create hybrid plants 91 m away from the original crop.

Weighing the Benefits

Although most experts see value in saving native plants, there is argument over the cost of saving them. Some experts say the diversity of plants species must be preserved for the health of the planet. Others say the cost for saving each plant is so high that people must determine its possible value before society pays the high cost of saving a species. In addition, some seed companies and farmers do not want to give up what they see as the money-saving potential of biotech crops.

Applying Critical-Thinking Skills

Directions: *Answer each question or respond to each statement.*

1. **Evaluate** Saving wild plant species is expensive. Do you think the government should spend its limited resources to save native plants? Explain your answer.

2. **Judge** What do you think about saving only those plants that might have a possible use to humans? Give reasons for your answer.

3. **Deduce** How could weeds that crossbreed with biotech crops become more aggressive?

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Challenge **LESSON 3**

Useful Plants

Plants are important to humans in many ways. For one thing, green plants take in carbon dioxide and release oxygen into our atmosphere. For this alone, we need plants. Plants also provide food and are the base of the land-based food webs. Plants have nonfood uses that are critically important to humans, such as fuel, building materials, textiles, chemicals, and medicines.

Research How People Use Different Plants

Research the list of plants below to find ways people use them. Complete the table based on your findings.

Some Plants and Their Usefulness to People		
Plant	**Useful Plant Part**	**Purpose/Product**
tree latex		
cabbage		
tree wood		
wheat		
broccoli		
lettuce		
peas		
willow tree		
asparagus		
celery		
cotton		
rice		
turnip		
corn		
tomato		
beans		
potato		
foxglove		
carrot		
maple tree		

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Lesson Quiz A

LESSON 3

Seed Plants

Multiple Choice

Directions: *On the line before each question or statement, write the letter of the correct answer.*

_____ **1.** All seed plants have
- **A.** cones.
- **B.** leaves.
- **C.** flowers.

_____ **2.** The major site of photosynthesis in a plant is the
- **A.** stem.
- **B.** roots.
- **C.** leaves.

_____ **3.** Which plant is a gymnosperm?
- **A.** tulip
- **B.** grass
- **C.** spruce

Matching

Directions: *On the line before each definition, write the letter of the term that matches it correctly. Each term is used only once.*

_____ **4.** plant leaves found in a seed and during early development

_____ **5.** vascular tissue that carries water and nutrients from the roots

_____ **6.** small opening in the epidermis of a plant leaf

_____ **7.** vascular tissue that carries dissolved sugars throughout a plant

_____ **8.** layer of tissue that produces new vascular tissue

- **A.** cambium
- **B.** cotyledons
- **C.** phloem
- **D.** stoma
- **E.** xylem

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Lesson Quiz B **LESSON 3**

Seed Plants

Multiple Choice

Directions: *On the line before each question or statement, write the letter of the correct answer.*

_____ **1.** Which plant part is **NOT** common to all seed plants?
- **A.** leaf
- **B.** root
- **C.** stem
- **D.** flower

_____ **2.** In which part of the leaf does most photosynthesis occur?
- **A.** cuticle
- **B.** stomata
- **C.** upper epidermis
- **D.** palisade mesophyll

_____ **3.** Angiosperms produce seeds inside of a
- **A.** fruit.
- **B.** stem.
- **C.** cone.
- **D.** flower.

Completion

Directions: *On each line, write the term that correctly completes each sentence.*

4. Plant leaves that are found in a seed and during early development are called _____.

5. _____ is the vascular tissue that carries water and nutrients from the roots to the rest of the plant.

6. _____ are small openings in the epidermis of a plant leaf.

7. _____ is the vascular tissue that carries dissolved sugars throughout a plant.

8. The layer of tissue that produces new vascular tissue is the _____.

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